

## REMARKS

This amendment is responsive to the Official Action mailed August 20, 2003. Claims 2-6, 9-13 and 16-20 are pending.

### I.

In the official action, the claims were rejected under 35 U.S.C. §112, first and second paragraphs, because “*as seen in applicant’s disclosure,*” recites the official action, “*applicant does not know what the second peak corresponds to, and therefore it is not known what the second peak is or to what it pertains.*” Respectfully, nowadays applicant does know all these things, and as more particularly discussed below in section II. herein. In view of the discussion there below in section II., reconsideration and withdrawal of these rejections under section 112, first and second paragraphs will be is requested.

Claims 3, 5, 10, 12, 17 and 19 8 were also rejected under 35 U.S.C. §112, first paragraph, purportedly because the limitation:

*...the single measurement and the information portion thereof excludes power information for times of time-of-flight slower than a benchmark corresponding to the time-of-flight value obtained in the absence of any egg or other object between the source and detector, which slower times of time-of-flight presumptively correspond to reflected noise...,*

is not supported in applicant’s disclosure. Which is odd, because with all due respect, applicant believes there is ample support. Although applicant has amended such limitation to change “*slower*” to “*longer*” as well as delete “*presumptively*” and “*reflected,*” applicant otherwise has preserved this limitation and requests reconsideration of the limitation (as amended). Example passages from the disclosure for support might include:

- P. 6, ll. 14-17:        *wherein the graph [FIG. 3] shows a profile of detected signal strength versus time for the special case of the source signal transiting across the gap to the detector without interposition of any object therebetween especially an egg (ie., therefore just through air),*
- P. 6, ll. 17-21:       *whereby the graph [FIG. 3] illustrates an example reference profile of detected signal strength versus time for such base factors as present air temperature and humidity as well as among various other things the distance of the gap between the transducers; such profiles in general consequently allowing analysis for such values as time-of-flight or velocity of the source signal*

P.11, ll. 14-16:       *The portion of the profile [FIG. 4] to right of the gate is noise. It might comprise echos of the source signal as scattered about by the environment.*

One reason for taking the measurement of Figure 3 is to determine where to set the gate in Figures 4 or 5. Figure 3 shows the time-of-flight of the ultrasonic signal in air, corresponding to about 240 microseconds. In Figures 4 and 5, any signal reaching the detector slower than that obviously did not transit the egg shell, because it was well known (and is borne out by Figures 4 and 5) that the speed of sound through the shell is faster than through air (speed of sound in water is faster than in air too).

The propagation of the effects of the source wave from its source to the detector *vis-a-vis* the egg can be likened to the way a tourist travels from city A to city B by car and part way over an express highway. Inside city A, the tourist has to drive slowly through traffic and intersections, hence the tourist's pace is slow. Reaching the express highway, the tourist can then speed up and go real fast. That will last only until the tourist must turn off the express highway when approaching city B, at which time the tourist's pace is slow again because of traffic and intersections.

The propagation of the effects of the source wave are this way too. The source wave's speed to the egg is slow. The oscillatory effects the source wave induces in the shell speed up to travel at any of the various speeds of sound for egg shell, which are faster than the speed of sound in air. The detection of those oscillations across the gap between the egg shell and the detector can only go across at the speed of sound in air, which is slow again. Therefore, the spectrum is gated (low passed) for any signals slower than the reference of air alone because those are not effects of the express highway trip *vis-a-vis* the egg shell, which is the object of study.

The terminology used in the limitation is appropriate in view of the disclosure as filed, and pursuant to 35 U.S.C. § 112, first paragraph, and the authorities interpreting 35 U.S.C. § 112, 1st ¶. See Vas-Cath, Inc. v. Mahurkar, 19 U.S.P.Q.2d 1111 (1991);<sup>1</sup> and, In re Wright, 9

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<sup>1</sup> In the case of Mahurkar, the disclosure of the invention in a design patent was deemed to provide a fully adequate basis to complete a written description of the invention in a continuation application for a *utility* patent (i.e., a design application served as parent for  
(continued...)

U.S.P.Q.2d 1649 (1989).<sup>2</sup> Reconsideration and withdrawal of this rejection is appropriate and is hereby requested.

Claims 3, 5, 10, 12, 17 and 19 were rejected under 35 U.S.C. §112, second paragraph for the recited term “*presumptively*.” This term has been deleted everywhere without prejudice. The matter to which the examiner refers has been corrected. The claims as amended are definite. Reconsideration and withdrawal of this other rejection under Section 112, second paragraph, is requested.

## II.

As introduced above, the claims were rejected under 35 U.S.C. §112, second paragraph because they “*state a time-of-flight value from source to detector and [this] is unclear to what this time of flight pertains.*”

Time-of-flight is the age of an effect measured at the detector, its birth corresponding to the launch of the wave from the source that ultimately propagated that measured effect. Consider the case of no egg. The source wave simply crosses the gap in air to the detector. Needless to

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<sup>1</sup>(...continued)

a utility application continuation). Accordingly, the amendments to the claim are appropriate in view of the drawings and description in the case, and approval is hereby requested.

<sup>2</sup> *The fact, therefore, that the exact words here in question, 'not permanently fixed', are not in the specification is not important. From the wording of the examiner's rejection it would seem that he did not know that; at least he wanted to be shown an 'unequivocal teaching' that the microcapsules are not permanently fixed. The board, on the other hand, launched into a discussion of whether the meaning of the words is clear and whether the specification contains 'guidelines' as to what they mean. It felt the words were open to 'different interpretation', which goes to the scope of the phrase rather than support for it. We deem this to be an irrelevant inquiry. These are common, garden variety words known to every English-speaking person. The Associate Solicitor who argued this appeal (who was not the author of the brief) said he had no difficulty understanding their meaning, nor do we. [Emphasis is original.]*

In re Wright, 9 U.S.P.Q.2d at 1651.

say, sound travels through air at the speed of sound for air. Hence, in the disclosure, time-of-flight for the signal through an air gap alone is stated this way:

*...the graph [FIG. 3] shows a profile of detected signal strength versus time for the special case of the source signal transiting across the gap to the detector...just through air..., whereby the graph illustrates an example reference profile of detected signal strength versus time for such base factors as...the distance of the gap between the transducers [or] analysis for such values as time-of-flight or velocity of the source signal*

Page 6, lines 14-21.

In contrast to flight through air, consider *arguendo* side-by-side objects A and B. Assume further that the objects are disposed in the gap such that both objects A and B are in the path for receiving some of the source's energy, and also that the detector can detect the effects from objects A and B simultaneously. Object A might propagate the effects of the source's energy faster to the detector than object B. Hence, for any given moment in time the source emits a quantum of energy, the effects induced by that quantum in object A will reach the detector faster than the effects induced by that quantum in object B. Conversely, for any given moment in time the detector detects effects in objects A and B, the effects detected in object B will have been propagated by an emission from source that was launched longer ago in history than the emission from the source producing the detected effect in object A.

Applicant has chosen to label the foregoing phenomenon "time-of-flight."

Now, to think again about hypothetical objects A and B, they permit an analogy to egg shell dynamics. Although an egg shell is not two objects, it can and does propagate the source-emissions' effects through itself at different speeds. It has been discovered that at least at 200 kHz, healthy shells carry waves at predominantly two characteristic speeds. It is now understood that the first-in-time power peak corresponds to the speed of sound for longitudinal waves in the shell (eg., compressive waves).

In distinction, the second-in-time power peak is a summation of various modes of shear waves (eg., the transverse wave shown in FIG. 2 is a shear wave) as well as surface acoustic waves ("SAW's") and SAW-like waves.

Although none are shown, SAW's would look like very fine sine waves in FIG. 2 if superimposed on either surface of the larger sinusoidal squiggle which is the shell as contorted by transverse bending.

Shear waves and SAW's travel at about the same speed of sound in objects. However, longitudinal waves are distinguished by traveling faster. In glass lunar rocks, the speed of sound for longitudinal waves is about 180% faster than the speed of sound for shear waves. A. Migliori and J.L. Sarrao, Resonant Ultrasound Spectroscopy (John Wiley & Sons: New York 1997), pp. 158. Shear waves can travel faster than SAW's, but something like only 105% to 110% faster for the examples given by Migliori et al., *supra*, at p. 33.

The time profiles shown by applicant's FIGS. 3 through 5 are features of the off-the-shelf equipment, eg., the NCA-1000-2En analyzer of SecondWave Systems, Inc., State College, Pennsylvania as recited in the disclosure at page 9, lines 14-15 (information on which was disclosed under the "Information Disclosure Statement"). There is nothing believed to be exceptional about the equipment's ability to produce such profiles. How it likely works is explained by A. Migliori and J.L. Sarrao, *supra*, at pp. 66-68.

Briefly, the technique is called "phase comparison." The source signal is driven at the constant operating frequency, it being disclosed for example a nominal operating frequency such as 200 kHz (eg., specification, page 9, line 8). However, by means of a "chopper," the source signal is also chopped into pulses for timing purposes. The pulses have a length and frequency as well as shape by design that is convenient for various circuits to identify and parse with precision, as well as manipulate as for or by phase comparison, phase locking, multipliers, summers and so on.

In essence, the phase of the detected signal is compared with the at-present phase of the chopper at work. Hence the phase in the detected signal is a product of chopper's history, and just how far back in history depends on how long the detected signal (including all its ancestral generations) has/have been out away from the source. Hence, the phase lag of the detected signal behind the at-present phase of the chopper corresponds to time or, more accurately, how far back in history it was when the chopper emitted the energy that propagated the detected-signal under scrutiny.

Things are actually more complex than the foregoing. Here, the detected energy is composed of effects that are products of waves launched at various different times in the past. That is, the detected energy is a scrambled composite of the effects of such. Accordingly, the detected signal is polyphase. Nevertheless, there are circuits that can sort apart such a composite of effects into fairly narrow bandwidths. Once sorted apart, then it can be readily determined what the individual bandwidths's phase lag is behind the chopper's at-present phase. Analyzers have long been known for sorting apart phase-differentiated signals for purportedly an indefinite number of phase angles between 0° and 360°. See, eg., U.S. Patent No. 4,455,680, assigned to NASA. To generate a graph of a spectrum of such bandwidth strength versus "time-of-flight" would seem to need only a memory register and a display screen.

Given the foregoing, applicant's disclosure in connection with *inter alia* FIGURE 4 particularly and distinctly discloses a distinguishing aspect of the invention. In the *Official Action*, it was recited that the claims contained subject matter

*which was not described in the specification in such a way as to enable one skilled in the [pertinent] art...to make and/or use the invention [because] applicant does not know what the second peak corresponds to, and therefore it is not known what the second peak is or what it corresponds to what it pertains."*

It seems as if the following passage is being held against applicant.

*Generally speaking, in FIGURE 4 the first peak in time (eg., at ~222 μsec as distinguished from the peak at ~235 μsec) has been discovered to most strongly correlate with egg shell quality. Hence the first peak in time might correspond to primary characteristic mode of oscillation whereas the second peak in time might correspond to a secondary mode, although to date this has not been established either way.*

Page 13, lines 6-10.

This shouldn't be held against applicant. In *In re Wands*, 8 U.S.P.Q.2d 1400 (Fed. Cir. 1988), a case dealing with methods for detection of hepatitis B surface antigens, the court noted that there was no disagreement as to the facts, but merely a disagreement as to the interpretation of the data and the conclusion to be made from the facts. Also in MPEP 2164.01(a).

Needless to say, discoveries have to be raced into the patent office, quickly as possible, before something bad happens. Applicant had an adequate basis to conclude that FIG. 4 is one of the best cases for egg shells, and in contrast FIG. 5 among the worst. Applicant supported its conclusions with a fairly impressive array of experiments.

*...Some eggs were immediately broken open for examination of the contents including the blastoderm for such visual determinations as alive and healthy, deformed, dead or near death and so on. Other eggs were marked and tracked for observations through hatchery operations up to hatching, if that occurred, and then continuing on with the emerging poult for about six days after.*

Page 10, lines 17-21.

The physics behind the appearance of twin peaks was guessed as owing to differences due to modes. What follows is a far richer explanation of why that is so. Consider how many modes a typical object might have.

*The phonons are the normal modes of vibration (or resonances) of a solid. For a typical chunk of matter that one might study in a laboratory, this approach [the authors' version of RUS] gets most of the  $10^{23}$  or so phonon modes correctly.*

Migliori et al., *supra*, p. 33.

To be sure, that is ten (10) to the power of twenty-three (23). Some modes allow sound to travel at the speed for longitudinal waves. But most modes only let sound travel at the slower speeds as for transverse waves, surface acoustic waves (SAW's), and SAW-like waves.

With so many modes, there is no wonder that there is an issue called "mode degeneracy." Briefly, when the measurable effects of several modes will pile up on top of each other so then the measuring equipment cannot resolve such "degenerate" modes' effects apart.

Mode degeneracy affords an important technique for searching for defects. In contrast, it so happens that longitudinal waves are not much good for finding small cracks, just large ones.

*If a crack goes just one tenth of the way through our rod — still a large defect — we would expect a frequency shift of 0.1% which now gets close to the change in frequency one might see from a large temperature drift or poor mounting....For a smaller crack, the longitudinal modes of this rod would be insensitive.*

Migliori et al., *supra*, p. 33.

However, manipulating degenerate shear or SAW-like modes is the tool of choice for defect detection.

*[Peak splitting is] another powerful diagnostic technique.... This technique works because some modes that, in a perfect part, have the same frequency, become separated (resolvable) because the lack of symmetry in the defective part removes the degeneracy. Refer to the bending mode depicted in [ ]. The cylinder actually has two orthogonal degenerate bending modes, both orthogonal to its axis. The bending stiffness for both these modes, and therefore their resonance frequency, is proportional to the diameter of the cylinder. Because the part is symmetric, both modes have the same frequency (the modes are said to be degenerate and appear to be a single resonance). However, when the symmetry is broken by a chip, crack or inclusion, the effective diameter is reduced for one of the orthogonal modes. This decreases the frequency for that mode, so both modes are seen.*

Migliori et al., *supra*, p. 178-79.

With super precise equipment and laboratory conditions, the following can be obtained.

*One finds that many modes have significant displacement only near the surface of a sphere. The SAW-like modes are of very high order and are at least 35-fold degenerate. Because of this complexity, it is rare to see a singlet in the diagnostic region. In fact, numerous correlations were made with known defective/perfect spheres to quantify the resultant splitting patterns. Figure 11.8 [see next page <sup>137</sup>] illustrates a nearly perfect sphere while Figure 11.9 shows the effect of a 170  $\mu\text{m}$  pit. This technique is so sensitive that fingerprints will cause a splitting on the order of a small defect.*

Migliori et al., *supra*, p. 183-84.

In summary, applicant concludes the following about FIGURE 4. The fast peak corresponds to effects traveling at the speed of sound for longitudinal waves. More recent egg data supports that, if both peaks are lost, then that egg will likely turn out to have a severe crack or flaw in it.

In distinction, if the fast peak is present but the slow peak is scattered, then that egg will likely turn out to have more subtle problems which may not manifest themselves until a dehydrated dying chick or poult struggles to break out. This is explained as follows. While the shell may sufficient integrity to carry longitudinal waves, it may have numerous small problems that interfere with the many-fold degenerate SAW-like modes. Longitudinal waves either aren't very sensitive



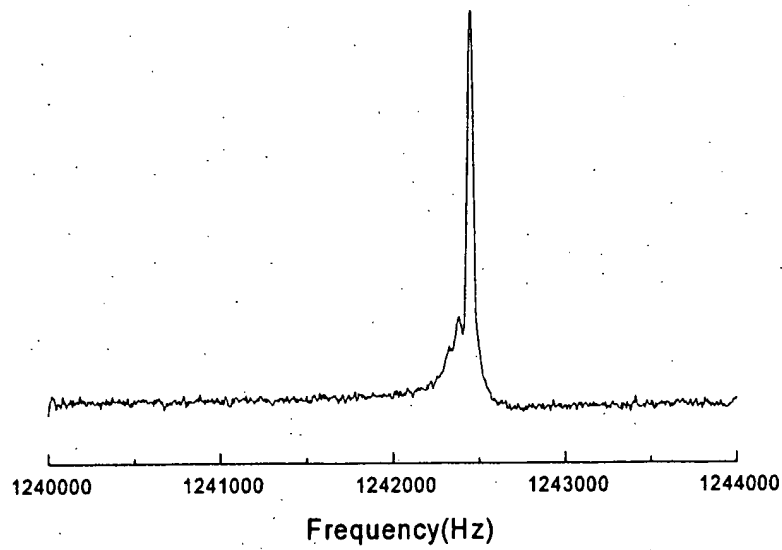
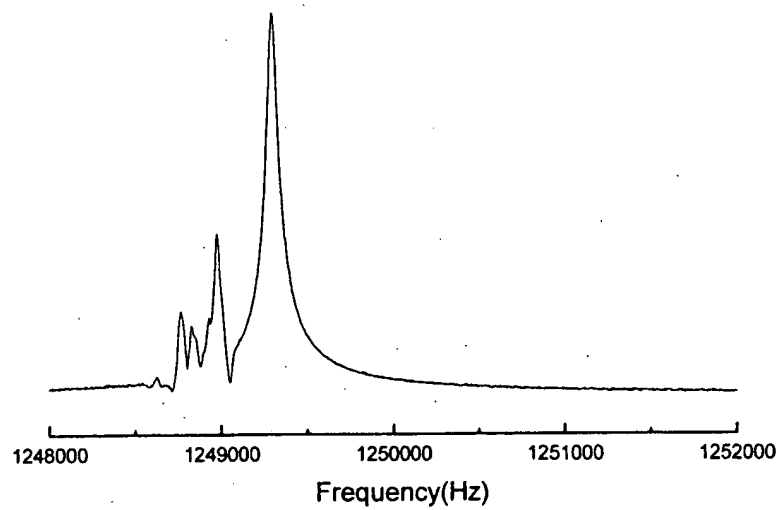


Figure 11.8 A SAW-like mode for a nearly perfect  $\text{Si}_3\text{N}_4$  sphere.



Figur 11.9 A SAW-like mode for a  $\text{Si}_3\text{N}_4$  sphere with a 170- $\mu\text{m}$  pit.

to small defects, or don't very often stack up in many-fold mode degeneracies. However, SAW-like are characterized by indeed piling up in many-fold mode degeneracies, a situation which can be exploited for testing for defects.

Accordingly, it is an advantage of the invention to analyze the detected signal according to a "time-of-flight" spectrum. This allows the spectrum to be resolved into a bandwidth of fast signals and a distinguished bandwidth of slow signals.

If the energy from the fast signals weren't distinguished from the slow signals, then the fast signals would mask the slow signals. The case of when the slow peak is lost but the fast peak is held might not be discernible. There might appear only a normal peak. By virtue of the slow peak being in a sufficiently distinguished "time-of-flight" bandwidth, it affords separate scrutiny independent of the fast peak.

In view of the foregoing, reconsideration and withdrawal of all this rejection under Section 112, first and/or second paragraph, is appropriate and is hereby respectfully requested.

### III.

Claims 2-4, 9-13 and 16-18 were rejected under 35 U.S.C. §102(b) as anticipated by the reference of Johnston et al. (U.S. Pat. 5,426,977). Claims 2-5, 9-12 and 16-19 were rejected under 35 U.S.C. §103(a) as unpatentable over the references of either Bliss (U.S. Pat. 3,744,299) or, alternatively, Schouenborg (U.S. Pat. 5,131,274), in view of the same reference of Johnston et al. Claims 6, 13 and 20 were rejected under 35 U.S.C. §103(a) as unpatentable over the reference of Johnston et al. or Bliss or Schouenborg as modified by Johnston et al., and in further view of the reference of Keromnes et al. (U.S. Pat. 5,017,003).

Reconsideration of claims 2-6, 9-13 and 16-20 is respectfully requested. The claims as amended particularly and distinctly define the subject matter of the invention. The differences between the invention and the prior art of record are such that the subject matter claimed as a whole is not shown by the prior art to have been known or obvious to a person of ordinary skill in the art at the time the invention was made.

The terminology used in the claims is appropriate in view of the disclosure as filed, and pursuant to 35 U.S.C. § 112, first paragraph, and the authorities interpreting 35 U.S.C. § 112, 1st ¶. See Vas-Cath, Inc. v. Mahurkar, *supra*, and, In re Wright, *supra*.

No reference of record teaches or suggests utilizing a source signal that requires only a single nominal operating frequency (ie., the frequency need not be swept), to provide a detected signal which is analyzed across a "time-of-flight" spectrum, which provides a check egg integrity by whether if two sufficiently steady and strong peaks are obtained.

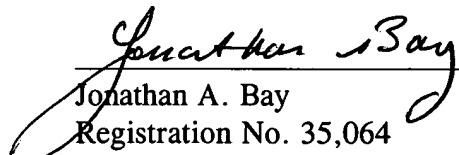
The prior art fails to disclose or suggest that two peaks in time-of-flight analysis, which can be as simply obtained as from only a monotone source, would have such advantages for predicting egg viability for hatchery operations. Thus the invention as particularly and distinctly defined in the claims is neither disclosed nor suggested in the prior art.

Allowance of all the claims is therefore appropriate and is hereby requested.

Every effort has been made to particularly and distinctly define the subject matter of the invention. The claims are definite, and are patentable over the prior art of record. The differences between the invention and the prior art are such that the subject matter claimed as a whole would not have been known or obvious to a person of ordinary skill in the art. Reconsideration, and allowance of all the pending claims, are respectfully requested.

Respectfully submitted,

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